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Rotator cuff syndrome: rehabilitation

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ORIGINAL ARTICLE

EVIDENCE COLLECTION METHODOLOGY:

We began the preparation of this guideline with the training of the authors using the methodology employed by the Oxford Centre for Evidence-Based Medicine, for the development of clinical guidelines for the *Programa Diretrizes da Associação Médica Brasileira-AMB* (Brazilian Medical Association's Guideline Program-BMA).

Articles were reviewed from the MEDLINE (PubMed) database and other research sources, on an open-ended basis. The search strategy used was based on structured questions in the P.I.C.O. form (from the initials of "Patient", "Intervention", "Control", and "Outcome").

The following are the search parameters for rotator cuff syndrome:

QUESTION 1: (Rotator Cuff or shoulder pain or shoulder impingement) AND (analgesics OR paracetamol OR acetaminophen OR dipyrone)

QUESTION 2: (Rotator Cuff or shoulder pain or shoulder impingement) AND (muscle relaxants OR cyclobenzaprine OR diazepam OR benzodiazepines OR carisoprodol OR tizanidine OR tetrazepam)

QUESTION 3: (Rotator Cuff OR shoulder pain OR shoulder impingement OR tendinopathy) AND (Anti-Inflammatory Agents, Non-Steroidal OR NSAIDs OR aspirin OR indomethacin OR diclofenac OR piroxicam OR tenoxicam OR meloxicam OR phenylbutazone OR ibuprofen OR naproxen OR nimesulide OR Cyclooxygenase 2 Inhibitors OR valdecoxib OR celecoxib OR etoricoxib)

QUESTION 4: (Rotator Cuff or shoulder pain or shoulder impingement) AND (Opioids or Narcotics or Morphine or Oxymorphone or Hydromorphone or Tapentadol or Morphine derivatives or Oxycodone or Hydrocodone or Fentanyl or Tramadol or Codeine or Buprenorphine or Methadone or Dextropropoxyphene)

QUESTION 5: (shoulder impingement syndrome OR rotator cuff OR tendinopathies OR shoulder pain) AND (antidepressant OR duloxetine OR venlafaxine OR amitriptyline OR nortriptyline OR clomipramine OR imipramine OR desvenlafaxine OR fluoxetine OR sertraline OR citalopram OR mirtazapine OR paroxetine OR tricyclic antidepressant OR dual antidepressant OR desipramine OR flufenazin OR bupropion OR escitalopram)

QUESTION 6: (Shoulder impingement syndrome OR rotator cuff OR tendinopathies OR shoulder pain) AND (Anticonvulsant Drugs OR Drugs, Anticonvulsant OR Anticonvulsive Drugs OR Drugs, Anticonvulsive OR Anticonvulsive Agents OR Agents, Anticonvulsive OR Antiepileptic Agents OR Agents, Antiepileptic OR Antiepileptic Drugs OR Drugs, Antiepileptic OR Antiepileptics OR zonisamide OR topiramate OR lamotrigine OR vigabatrin OR tiagabine OR pregabalin OR gabapentin OR valproate OR divalproate OR acid, valproic OR benzodiazepine OR carbamazepine OR phenytoin OR phenobarbital OR primidone)

QUESTION 7: (Rotator cuff OR tendinopathies OR shoulder pain OR shoulder impingement syndrome) AND (acupuncture OR electroacupuncture OR moxibustion OR acupoint OR acupoints)

QUESTION 8: (Rotator cuff OR tendinopathies OR shoulder pain OR shoulder impingement syndrome) AND (needle or needling or needles or hypodermic needles or Hypodermic needle or dry needling)

QUESTION 9: Rotator Cuff AND (Anesthetics, Local OR injections, intra-articular)

QUESTION 10: (Rotator Cuff OR Tendinopathy OR Shoulder Pain OR Shoulder Impingement) AND Myofascial Pain Syndromes)

QUESTION 11: (Rotator cuff OR tendinopathies OR shoulder pain OR shoulder impingement syndrome) AND (Anesthetics, Local OR Nerve Block OR Myofascial Pain Syndromes)

QUESTION 12: (Rotator Cuff OR Shoulder Impingement Syndrome) AND (Exercise Therapy OR Exercise OR Proprioception)

QUESTION 13: (Rotator cuff OR tendinopathies OR shoulder pain OR shoulder impingement syndrome) AND (Extracorporeal shock wave therapy OR extracorporeal shock wave therapy)

QUESTION 14: (Rotator cuff OR tendinopathies OR shoulder pain OR shoulder impingement syndrome) AND (bandages OR kinesiotaping OR athletic tape)

QUESTION 15: (Rotator cuff or shoulder pain or shoulder impingement syndrome or shoulder impingement) AND (orthotic devices or orthosis or orthoses or orthotic or braces or brace or splints or splint or casts, surgical or cast)

QUESTION 16: (Rotator cuff OR tendinopathies OR shoulder pain OR shoulder impingement syndrome) AND (postoperative or post-operative or post operative or postoperative care or post-operative care or post operative care or postoperative period or post-operative period or post-operative period or postoperative or post-operative or post operator or postoperative care or post-operative care or post operator care or postoperative period or post-operative period or post operator period or rehabilitation)

These descriptors were used as correlations according to the proposed theme of the PICO questions. After analyzing this material, articles relative to the questions were selected that yielded evidence on which to base the present guideline.

QUALITY OF EVIDENCE AND STRENGTH OF RECOMMENDATIONS:

- A: Experimental or observational studies of high quality.
- B: Experimental or observational studies of lesser quality.
- C: Case studies (uncontrolled studies).
- D: Opinion with no critical evaluation, based on consensuses, physiological studies or animal models.

OBJECTIVE:

To offer information on the treatment of rotator cuff syndrome.

PROCEDURES:

Therapeutic interventions to rehabilitate the main clinical manifestations that impair the quality of life, functionality, and daily life activities of patients with dystonia.

CONFLICT OF INTERESTS:

The authors have no conflicts of interest to declare.

INTRODUCTION

Shoulder problems are the third most frequent disorder of the musculoskeletal system - after problems in the lumbar and cervical regions.¹ In the general population, there is an estimated annual incidence of 7%² and annual prevalence of 5% to 47%, and approximately 40% of the cases become chronic.² The prevalence of shoulder pain combined with a restricted range of movement due to pain impairs the execution of daily life activities and afflicts 20% of the general population.^{4,5} Based on a broad review made in the United Kingdom on shoulder pathologies, pain is responsible for an estimated cost to society of about 100 million pounds.²

The incidence of joint pain increases with age.⁶ Thus, with an aging population, the number of patients with complaints of shoulder pain and consequent impairment tends to grow.

The socio-economic impact of shoulder pathologies is considerable: it reaches an economically active population and, for the elderly, it adds and/or causes dependence on third parties, which represents a high cost to society.

Rotator cuff injuries (RCI) are very prevalent among the causes of shoulder pain, including tendinitis and partial and total ruptures of the cuff tendons.

This guideline proposes to include adult and elderly patients in acute and chronic phases of the rotator cuff syndrome-that is, patients with shoulder pain for approximately 6 weeks caused by injuries to the rotator cuff.

Studies were excluded from this work if they concerned post-surgical patients with no proposal of rehabilitation, if they were athletes, or if they had: impact syndrome, osteoarthritis, rheumatoid arthritis, fracture, neuropathy, pain not in the shoulder or attributed to the rotator cuff, luxation or sub-luxation, and painful shoulder after a stroke.

THERAPEUTIC SESSION

1. IS IT RECOMMENDED TO USE SIMPLE ORAL ANALGESICS IN THE TREATMENT OF ROTATOR CUFF SYNDROME?

In the literature, there are no randomized studies or case series that recommend the use of simple analgesics, however, it is a broadly used medication in clinical practice for rotator cuff pain in acute phases or in the worsening of chronic pain from slight to moderate, or in association with other classes of medication. The most commonly used medications are Paracetamol with the usual dosage of 500-750 mg and Dipyrrone from 500 mg to 1 g, every 6 hours, and they can be combined. In case there is no improvement with the use of such medications, it is recommended to stagger the dosage based on the World Health Organization (WHO) (D) scale.

RECOMMENDATION

It is recommended to use simple analgesics such as paracetamol with the usual dosage of 500-750 mg, or dipyrrone from 500 mg to 1 g, every 6 hours, or a combination of both in the treatment of acute pain or in the worsening of chronic pain related to rotator cuff syndrome (D).

2. IS IT RECOMMENDED TO USE MUSCLE RELAXANTS IN THE TREATMENT OF ROTATOR CUFF SYNDROME?

In the literature, there are no randomized studies or case series that recommend the use of muscle relaxants, however, it is a broadly used medication in the clinical practice when there are associated symptoms of myofascial pain syndrome. The most used medications are cyclobenzaprine in the dosage from 5 to 10 mg once a day up to every 12 hours, but there are side effects that limit the therapy: sleepiness, dry mouth, and dizziness. To avoid sleepiness during the day, it is recommended to take the medication 2 or 3 hours before bedtime. A dose of carisoprodol of up to 350 mg a day is also used, phenylbutazone 200 mg every 12 hours or up to every 8 hours, and thiocolchicoside in a single dose of 4 mg or up to every 6 hours. These medications are normally found in association with analgesics (D).

RECOMMENDATION

The use of muscle relaxants for rotator cuff syndrome with associated painful myofascial symptoms is recommended. In clinical practice, 5 to 10 mg of cyclobenzaprine is used once a day or every 12 hours, with the limiting factor being the side effects of sleepiness,

dry mouth, and dizziness. It is also recommended to use a single dose of 350 mg of carisoprodol a day, 200 mg of phenylbutazone every 12 hours or even every 8 hours, and thiocolchicoside in a single dose of 4 mg or even every 6 hours (D).

3. WHAT IS THE EFFECTIVENESS OF USING ANTI-INFLAMMATORY DRUGS IN THE TREATMENT OF ROTATOR CUFF SYNDROME?

The use of non-steroidal anti-inflammatories (NSAIDs) orally or locally is effective in the relief of pain associated with tendinopathies in the short term (7 to 14 days); however, in patients with longer-term or more serious symptoms, there is less chance of success using an NSAID.⁷ The use of Celecoxib with an initial dose of 600 mg, followed by 200 mg a day, for 14 days reduces approximately 30% ($p < 0.05$) of the pain. Celecoxib and Naproxen at 500 mg a day are similar in reducing pain, but the pain reduction occurs one day before when compared to Celecoxib⁸ (B). The use of 100 mg of Nimesulide, twice a day for 14 days to treat acute shoulder pain in adult patients reduces the value of the total score of symptoms by approximately 70% ($p < 0.05$; IC 95%)⁹ (B). The use of 100 mg of Nimesulide twice a day has a better risk/benefit ratio for safety and tolerance, but efficacy similar to other NSAIDs¹⁰ (B).

In addition, we indicate 400 mg of Celecoxib a day for 14 days for acute shoulder pain to reduce up to 70% of pain while at rest and in the recovery of function¹¹ (B). Thus, many NSAIDs have shown effectiveness in the control of acute shoulder pain. The use of Nimesulide or Naproxen for shoulder tendinitis and bursitis after 14 days reduces movement pain by 70%. The use of 7.5 to 15 mg of Meloxicam or 20 mg of Piroxicam a day for 7 days reduces movement pain¹¹ similarly (B). The record of efficacy and safety between the different NSAs is similar. The most common side effects are cephalaea, dyspepsia, and nausea.

RECOMMENDATION

The use of NSAIDs is recommended for acute pain associated with symptoms of rotator cuff tendinitis and bursitis. They promote reduction of pain while at rest or in movement, and help to restore function with similar efficacy, for example: Celecoxib - 400 mg a day or an initial dose of 600 mg followed by 200 mg a day, Naproxen - 500 mg a day, Nimesulide - 100 mg twice a day for 14 days, Meloxicam - 7.5 to 15 mg, or Piroxicam - 20 mg of a day for 7 days (B).

4. IS THE USE OF OPIOIDS EFFECTIVE IN THE TREATMENT?

Early mobilization after shoulder surgery plays a vital role in successful functional rehabilitation. Nevertheless, post-surgical pain many times reduces or even impedes the efficacy of physiotherapy.

To perform physiotherapy in the first 72 hours after open shoulder surgery, the analgesia controlled by the patient through interscalene technique (PCISB) using Ropivacaine at 0.2% (10 mg/h as a limit) and maximum daily dose of 450 mg, via interscalene catheter, reduces pain while at rest, at 6 hours ($p < 0.001$), 24 h ($p = 0.044$), and 72 h ($p = 0.013$), and pain during physiotherapy 48 hours post-surgery ($p = 0.016$), being superior to the use of patient-controlled intravenous opioid analgesics (PCA), with a bolus of 2 mg of Piritramide, with maximum daily dose of 30 mg, for the first 72 hours after surgery. Both techniques improve functionality similarly when evaluated by the Constant scale¹² (B).

RECOMMENDATION

For early rehabilitation after open shoulder surgery, the use of patient controlled analgesia using opiates with a maximum daily dose of 30 mg or patient controlled analgesia using an interscalene anesthetic infusion are similar in improving functionality, however, the interscalene technique with Ropivacaine injection at 0.2% to a maximum of 10 mg/h, and maximum daily dose of 450 mg, reduces pain at rest for up to 72 hours and during physiotherapy for 48 hours (B).

5. IS THE USE OF ANTIDEPRESSANTS EFFECTIVE IN THE TREATMENT OF ROTATOR CUFF SYNDROME?

There are no studies in the literature showing the use of antidepressants to treat rotator cuff syndrome, however, in clinical practice this class of medication is used in patients with chronic musculoskeletal and/or neuropathic pain (D).

Tricyclic antidepressants in low doses are used, and their dosage can be gradually increased if there are associated humor or sleep disorders. The initial dose used of Amitriptyline is 12.5 to 25 mg or 10 to 25 mg of Nortriptyline at night. Nortriptyline is mostly indicated for the elderly for it causes less postural hypotension. It is also common to use 25 mg of Imipramine or Clomipramine at night (D).

The antidepressants that inhibit the reuptake of serotonin and norepinephrine such as Duloxetine and Venlafaxine can also be used. Duloxetine is used at 30 to 60 mg a day and Venlafaxine from 37.5 to 150 mg (D).

RECOMMENDATION

In patients with chronic musculoskeletal and/or neuropathic pain, low doses of tricyclic antidepressants are recommended: initial dose of Amitriptyline from 12.5 to 25 mg or Nortriptyline from 10 to 25 mg, at night. Nortriptyline is mostly recommended for the elderly for it causes less postural hypotension. Imipramine or Clomipramine can also be used, dosed at 25 mg at night. Antidepressants are also recommended that inhibit the reuptake of serotonin and norepinephrine such as Duloxetine from 30 to 60 mg a day and Venlafaxine from 37.5 to 150 mg a day (D).

6. IS THE USE OF ANTICONVULSANTS EFFECTIVE IN THE TREATMENT OF ROTATOR CUFF SYNDROME?

The dose of 300 mg of Gabapentin every 12 hours for 48 hours has shown significant reduction of pain ($p 0.02$) in patients after arthroscopic surgery to repair the rotator cuff,¹³ although the results are controversial¹⁴ (B). When there is chronic musculoskeletal pain associated or not with neuropathic pain with no response to a previous treatment with analgesics and/or anti inflammatory medication, then treatment with Gabapentin at the minimum dose of 300 mg every 8 hours can be considered in order to diminish the allodynia caused by the central hypersensitization of pain, and in addition, 200 mg of Carbamazepine starting once a day up to every 8 hours (D).

RECOMMENDATION

The use of 300 mg of Gabapentin every 12 hours for 48 hours to reduce pain after surgery to repair the rotator cuff arthroscopically is recommended (B). For symptoms of chronic musculoskeletal pain associated or not with neuropathic pain and/or allodynia caused by the central hypersensitization of pain, with no response to a previous

treatment with analgesics and/or anti inflammatory medication, Gabapentin is used at the minimal dose of 300 mg every 8 hours or 200 mg of Carbamazepine starting at once a day and up to every 8 hours (D).

7. IS ACUPUNCTURE EFFECTIVE IN THE TREATMENT OF ROTATOR CUFF SYNDROME?

Fifteen sessions of acupuncture applied by qualified professionals in accordance with the location of pain (anterior: P1, 2; anterolateral: LI4, LI11, LI14, and LI15; lateral: TE5, TE13, and TE14; posterior: SI3 and SI9) associated with 1-3 Ah-shi points (GB34, ST38, and BL58) reduce 50% of the pain in 65% of the patients (CI95% 56-74%) after 3 months from the beginning of treatment, being superior to conventional treatment with 50 mg of diclofenac a day associated to 15 physiotherapy sessions, physical exercises, thermotherapy, ultrasound or TENS ($p < 0.001$, NNT 3, RRR 44% CI95% 29 to 59%, RAR 0.31) and to the placebo ($p < 0.001$, NNT 5, RRR 34% CI95% 15-52%, RAR 0.20). There were no adverse effects observed in this intervention¹⁵ (A).

Two weekly sessions of acupuncture in the LI15, TE14, SI19, SI10-13, BL41-46 points and 4 Ah-shi points combined with an anti-inflammatory diet of fish, fruit, vegetables, nuts, and grains, plus 2 pills composed of 90 mg of bromelain, 48 mg of trypsin, and 100 mg of rutin three times a day provided a reduction in pain and improved the functionality measured by the Shoulder Pain and Disability Index, which is superior to conventional therapy of 30 minutes weekly after 12 weeks of treatment (-29.7; CI95% -42.35 a -16.98, $p < 0.0001$)¹⁶ (A).

Acupuncture is also recommended for its lasting effects, which are perceptible as much in the area of pain as in the quality of life ($p < 0.01$). Ten acupuncture sessions improve, for up to 3 years, the quality of sleep ($p < 0.01$), reduce depression ($p = 0.04$), and anxiety and irritability ($p = 0.02$), in addition to pain reduction related to domestic chores ($p = 0.03$), and work ($p = 0.04$)¹⁷ (A). Auriculotherapy shows little effect, however it is perceptible for up to 3 months (D).

RECOMMENDATION

Fifteen sessions of classic acupuncture are recommended twice a week to reduce pain and to improve functionality and associated symptoms (anxiety, depression, irritability, and quality of sleep) in the rotator cuff syndrome. The points used were: LI4, LI11, LI14, LI15, P 1,2, TE5, TE13, TE14, SI3, SI9, SI10-13, SI19, GB34, ST38, BL41-46, BL58, and Ah-shi points. Auriculotherapy shows little effect, however it is perceptible for up to 3 months (D).

8. IS THE DRY NEEDLING EFFECTIVE IN THE TREATMENT OF ROTATOR CUFF SYNDROME?

For patients with myofascial pain syndrome of the infraspinous muscle and shoulder pain, dry needling of trigger points of that muscle showed an immediate reduction of pain measured by the VAS (7.8 ± 1.2 to 2.8 ± 1.1) and improvement of range of movement measured by goniometry of the treated shoulder - active range (from $47.5^\circ \pm 16.4^\circ$ to $70.7^\circ \pm 16.5^\circ$ ($p < 0.01$)) and passive (from $51.8^\circ \pm 15.5^\circ$ to $77.5^\circ \pm 15.3^\circ$ ($p < 0.01$)). However, the duration of the effects shown by this procedure is unknown¹⁸ (B).

RECOMMENDATION

To treat shoulder pain combined with myofascial pain syndrome of the infraspinous muscle, dry needling of the muscle's trigger points

is recommended, for immediate pain reduction and improvement of range of movement (B). More studies are needed to verify the duration of these effects in the short and long terms.

9. WHAT IS THE BENEFIT OF INTRA-ARTICULAR AND SUBACROMIAL INFILTRATION IN THE ROTATOR CUFF SYNDROME?

One single intra-articular corticoid infiltration with anesthetic (0.5 ml of triamcinolone at 40 mg/ml, 3.5 ml of bupivacaine at 5 mg/ml, and 3 ml of physiological solution) increases the range of movement by 32° and reduces the pain by 80% ($p < 0.01$) if applying 3.5 ml in the glenohumeral articulation, 2.5 ml in the subacromial space, and 1 ml in the acromioclavicular articulation, after local anesthesia with 0.5 ml of prilocaine and combined with exercises (stretching, pulley, Codman exercises, fingerladder). Although 15 sessions of TENS (transcutaneous electrical nerve stimulator) in the anterior and posterior regions of the shoulder for 30 minutes, five times a week with 100 Hz, 15 mA, and a 150 μ s amplitude, associated to the same exercise program reduces pain and improves the amplitude of movement ($p < 0.001$). Articular infiltration is better than TENS at reducing pain for up to 12 weeks after treatment ($p < 0.05$)¹⁹ (A).

A local corticoid subacromial infiltration guided by ultrasound (2 ml solution of 10 mg/ml of triamcinolone with 5 ml of 10 mg/ml of lidocaine) combined with a 4 ml lidocaine injection in the high gluteus region for systemic absorption, reduces the pain by 45% and lessens impairment ($p < 0.001$). In the same way, the application of a corticoid in the gluteus region for systemic absorption (2 ml of triamcinolone with 2 ml of lidocaine) associated with subacromial infiltration of 5 ml of lidocaine reduces the pain by 37% ($p < 0.001$). The adverse effects observed were slight, such as flushing, dizziness, and the sensation of heat²⁰ (A). There was one report of flushing and hoarseness that appeared within 24 hours after the procedure and disappeared spontaneously, the former in 2-3 hours and the latter in 48 hours.²¹ (C).

In elderly patients with rotator cuff syndrome and no indications for surgery, one single corticosteroid articular infiltration (40 mg of triamcinolone), or repeated after 21 days associated with 15 sessions of 20 minutes of passive mobilization of the glenohumeral articulation and stretches for cuff muscles, reduces pain during movement by more than 45% and night pain for up to 6 months from the application²² (B).

A corticoid subacromial injection improves the range of movement in shoulder abduction (average difference of angles: 35° - CI95%: 14-55), however, it did not show any benefit to the range of movement when associated with an oral anti-inflammatory (CI95%: -14 to 22) or pain (-11 to 7)²³ (A).

A corticoid subacromial injection improves rotator cuff tendinitis with relative risk of 3.08 (CI95%: 1.94-4.87) being necessary to treat 3.3 patients (CI95%: 1.8-7.7) to obtain improvement in one patient (CI 95%: 1.8-7.7). The use of high doses of corticosteroids (dose of 50 mg or more of prednisone) showed a more important improvement with relative risk of 5.9 (CI95%: 2.8-12.6). In addition, the corticosteroid infiltration improves as much as the infiltration with non-steroidal anti inflammatory medication with relative risk of 1.43 (CI95%: 0.95-2.16) needing 2.5 patients treated with corticosteroid in relation to anti inflammatory medication for one patient to improve (CI95%: 1-9)²⁴ (A).

A corticoid subacromial infiltration of anesthetic (6 mg of betamethasone combined with 4 ml of Xylocaine at 2% with no

vasoconstrictor) as well as an isolated anesthetic (5 ml of Xylocaine at 2%) in adult patients with therapeutic failure after 2 weeks of using non-hormonal anti-inflammatories and 6 weeks of physiotherapy was effective for improving the quality of life of the patients for up to 6 months after application²⁵ (A). A subacromial infiltration of 2.5 ml of sodium hyaluronate (25 mg), when applied once a week for 5 weeks improves shoulder function by 28% (measured on the Constant scale) for up to 6 weeks after the end of the treatment²⁶ (A) or 2 ml of sodium hyaluronate (10 mg/ml) once a week for 5 weeks with an improvement in pain of 27% for up to 17 weeks after treatment ($p = 0.001$)²⁷ (B).

As much by anteromedial as by posterior, infiltration can be done blindly by an experienced orthopedist if there is a positive correlation with the area indicated by Magnetic Resonance Imaging 66% of the time²⁸ (A). Also, subacromial infiltration done blindly or guided by ultrasound have equal accuracy²⁹ (B).

RECOMMENDATION

Subacromial infiltration can be done with hormonal or non-hormonal anti-inflammatories, sodium hyaluronate, or anesthetic and effectively reduce pain, range of motion, and functionality with the best improvement if used with doses of prednisone of more than 50 mg(A). Subacromial infiltration with corticoids combined with gluteal injections of anesthetic or a subacromial infiltration of anesthetic and a gluteal infiltration of corticoid can be recommended to improve the pain and the disability, with no difference as to local or systemic absorption of the corticoids. Among aging people with no surgical prescription, the intra-articular infiltration can be applied in a single session or repeated in 21 days in conjunction with 15 sessions of 20 minutes of passive mobilization of the glenohumeral joint and stretching of the cuff muscles to improve pain for up to 6 months (B). Subacromial infiltration can be done blindly from the anteromedial side as well as from the posterior, or it can be guided by ultrasound when done by an experienced professional (A).

Intra-articular infiltration is indicated with or without corticoids to improve the range of motion and pain when supplemented with exercises (stretching, pulley, Codman exercises, and fingerladder). The use of TENS (transcutaneous electrical nerve stimulator) in the anterior and posterior regions of the shoulder for 30 minutes 5 times a week at 100 Hz, 15 mA, and 150 μ -sec rise time in combination with these exercises can also be recommended if doing the intra-articular infiltration is not possible, however the infiltration shows better results for up to 12 weeks (A).

10. IS IT RECOMMENDED TO USE INTRAMUSCULAR INFILTRATION IN THE ROTATOR CUFF SYNDROME?

A single posterior infiltration of the muscle on the outer edge of the scapula of 1 ml of triamcinolone and 1 ml of 2% mepivacaine with a 21 G needle revealed a partial improvement when evaluated by the Visual Analog Scale (VAS) (improvement from 3 to 5 points - before and after 7 days of treatment)³⁰ (A).

The use of a single application of botulinum toxin at patients' trigger points of those who complained of moderate to intense pain on a scale of 1 (no pain) to 4 (intense pain), with needles of 27 G x 40 mm and syringes of 2.5 ml, at a depth of 1 to 3 cm, and a dose of 40 units of type A Botulinum Toxin per point, at 10 of the most active painful trigger points on unspecified muscles, with re-evaluations at 5, 8, and 12 weeks post-application showed that

there was a benefit in the treatment for Myofascial Pain Syndrome, with an improvement in pain of 2-3 points on the pain scale used. Muscular infiltration with low doses of botulinum toxin, at a dose of 5 IU on patients with Myofascial Pain Syndrome in the region of the shoulder and neck, in the trapezius, the levator scapulae, and the infraspinatus muscles with a total dose that ranged from 0.15 ml to 0.35 ml (containing 15 to 35 IU of the toxin) depending on the number of active trigger points, showed that there was no significant difference in the use of low doses of the botulinum toxin on patients with Myofascial Pain Syndrome in the cervical and shoulder region. For shoulder pain with trigger points on the infraspinatus muscle, a single muscular infiltration was done with 50 IU/0.25 ml of botulinum toxin refrigerated to between 2 and 8°C using needles of 26 G x 55 mm, and pain evaluation was done using the Visual Analog Scale from 0 to 10 (0 = no pain and 10 = intolerable pain) after 4 visits with intervals of 1 week between the 1st and the 2nd, the 3rd visit was done 3 to 5 days after the application, and the 4th visit 28 days after the application; there was a significant reduction of spontaneous and referred pain and a reduction of 3-5 points on the Visual Analog Scale³¹⁻³³ (A).

The side effects observed were headaches and pain at the application site.

RECOMMENDATION

A single muscular infiltration on the outer edge of the scapula of 1 ml of triamcinolone and 1 ml of 2% mepivacaine is recommended to reduce the pain of patients diagnosed with tendinitis of the rotator cuff with a symptomology of less than 6 weeks who have not responded to previous medical treatment with oral anti-inflammatories for one week.

A single intramuscular application of type A Botulinum Toxin in the infraspinatus muscle with a dose of 50 IU and at another 10 most active painful trigger points on unspecified muscles of the scapular girdle at a dose of 40 IU per point is recommended to improve the pain of patients with rotator cuff syndrome.

11. WHAT IS THE BENEFIT OF A NERVE BLOCK IN ROTATOR CUFF SYNDROME?

Blocking the suprascapular nerve (SSNB) significantly reduces the pain caused by tendinitis of the rotator cuff if compared with the usual isolated physiotherapy ($p = 0.016$). There is a reduction of pain for one week or long term after SSNB even after it has been metabolized and the anesthetic effect has worn off. The SSNB improves the performance of daily life activities (DLA) in 85% of the patients ($p = 0.001$) and the quality of sleep at night in 95% of the patients ($p = 0.011$), with NNT = 3.33 to improve the sleep hampered by pain. The effectiveness of the blocker was analyzed by the UCLA Scale for the shoulder using the chi-square test with IC = 95% and $\alpha = 0.05$. The SSNB was done with 10 ml of 2% lidocaine in a sterile saline solution and the usual physiotherapy included ice, bent-over exercises with 5 series of 20 repetitions and exercises that progressed from isometrics to isotonic at different ranges of movement even in the presence of slight pain³⁴ (B).

There was no statistically significant benefit of a SSNB or a corticosteroid infiltration in the treatment of 60 patients with non-specific shoulder pain. The SSNB was done with 10 ml of 1% lidocaine and the corticosteroid infiltration in the subacromial space and in the bicipital groove with 40 mg of methylprednisolone and 6 ml of 1% lidocaine, both combined with a home exercise program. There was one month of monitoring and pain evaluation (measured

with the Visual Analog Scale), range of motion, satisfaction of the patient, and pain disability of the shoulder. SSNB is preferred over corticosteroid infiltration (CI) due to there being more contraindications and adverse reactions to the CI injection³⁵ **(B)**.

Guided by anatomical parameters, SSNB is safe and improves pain and functionality equally to SSNB guided by Computerized Tomography in patients with RCI (Rotator Cuff Injury) alone or associated with bicipital tendinitis, acromioclavicular arthritis, glenohumeral arthritis, or rheumatoid arthritis-which previously were submitted to treatment by oral pharmacology and/or intra-articular infiltration with corticosteroids. [with power of 80% and $\alpha = 0.05$]³⁶ **(B)**. The SSNB represents a general patient satisfaction index of 7.4 (maximum = 10) even after 12 weeks³⁶ **(B)**.

SSNB is an effective but temporary analgesic on patients with tendinitis or torn rotator cuff who are not responsive to corticosteroid injections in conjunction with physiotherapy, including mobilization exercises and physical means. SSNB with 2 ml of a solution of 40 mg methylprednisolone and 0.5% bupivacaine compared with an SSNB sham with 2 ml of sterile saline solution reduced the night pain as much in patients with tendinitis (for 12 weeks $p < 0.02$) as with torn rotator cuff (for 4 weeks $p = 0.013$); in the group with tendinitis, the ROM improved active abduction (for 4 weeks $p = 0.006$), flexion (for 12 weeks $p = 0.03$), and outward rotation (for 4 weeks $p = 0.02$); it reduced the pain of movements in patients with torn rotator cuffs (for 12 weeks $p = 0.004$)³⁷ **(B)**.

RECOMMENDATION

There is no level **(A)** evidence for the treatment of patients with pain from rotator cuff injuries by nerve blocks. There is no level **(B)** evidence, at least, on the treatment with nerve blocks other than SSNB for RCI that are not for analgesia after shoulder surgeries.

Blocking the suprascapular nerve with 5 to 10 ml of 1% lidocaine guided by anatomical parameters in patients with Rotator Cuff Syndrome with the goal of lasting analgesia (up to 12 weeks), improves the sleeping standards when hampered by pain, improves ROM, and improves functionality in the DLAs as an adjunct to shoulder exercise therapies **(B)**, and, therefore, is recommended. The SSNB is safe, with reports only of minor local reactions as an adverse event following the technique of anatomical references for the procedure.

However important a suprascapular nerve block may be as an adjunct treatment in the physical reconditioning of the shoulder, there is no evidence-based data on its isolated effectiveness and its excellent periodicity of repetition. Besides, the mechanism of the suprascapular nerve block is not yet fully understood. Studies with greater scientific rigor on the blocking of the suprascapular nerve in patients with RCI and associated shoulder pain are necessary.

12. DOES SHOCK WAVE THERAPY BENEFIT THE TREATMENT OF ROTATOR CUFF SYNDROME?

Shock wave therapy (SWT) shows benefits in the reduction of pain and in improvement of shoulder mobility for those with injured rotator cuffs and there are various ways of applying the method. One session of SWT every 6 weeks or until the pain improves, for a maximum of 5 sessions, when done with a piezoelectric device focused on the area of the tendinous calcification of the shoulder under echo-location on patients with pain for more than 6 months with no improvement with at least 10 physiotherapy sessions

experienced a diminution of type I and II tendinous calcification on the Gaertner & Heyer Scale. When high energy is used (1500 pulses and 0.44 mJ/mm²) there was an immediate pain reduction as well as after 6 months. With low energy (1500 pulses and 0.15 mJ/mm²) there was an immediate pain reduction and an 87% drop in recurrence of cases at 6 months ($p < 0.001$)³⁸ **(B)**.

The low energy procedure is safe (ARR: -0.067 and CI95%: -0.067 to 0.022; NNT: 15 and CI95%: 6 to ∞) however, with high energy there is an increased risk of bruising (ARR: -0.194 and CI95%: -0.333 to -0.055; NNT: 5 and CI95%: 3 to 18) observed in 19% of the cases ($p < 0.001$) and pain in 81%, and more effectiveness, for many times it was treated in only one session ($p < 0.001$) and there was no clinical recurrence for up to 6 months³⁸ **(B)**.

A total of 3 weekly sessions of SWT with a focused apparatus of low energy (1000 pulses and 0.08 mJ/mm² at 4 Hz) on the shoulder with conventional localization (point of greatest sensitivity to the touch) or with radiological localization of the shoulder calcification, on patients with calcified tendinitis of the supraspinatus and shoulder pain for more than 6 months, with no improvement with 2 conservative treatments yielded a reduction in the pain and a reduction in the Visual Analog Scale (VAS), an improvement in functionality on the Constant and Murley Score (CMS), and an improvement in calcification as evaluated in shoulder radiography after 12 weeks of treatment. However, the improvement was significantly greater in the group using radiological localization on the VAS ($p = 0.0236$) as well as in the CMS ($p = 0.0208$)³⁹ **(B)**.

On patients with rotator cuff injuries with no torn tendons or calcification, but with pain for more than 6 months and failure of conservative treatments (at least 10 physiotherapy sessions, 2 subacromial corticoid injections, and non-steroidal anti-inflammatories), 3 weekly shock wave therapy sessions with 2000 impulses of high energy (0.78 mJ/mm²) or low energy (0.33 mJ/mm²) on the origin point of the supraspinatus tendon. There was an improvement in shoulder function after 12 weeks and after one year from the use of high energy ($p < 0.001$) and low energy ($p = 0.006$). The reduction of pain, evaluated by the VAS at rest, at 12 weeks, and at one year, took place after the high energy ($p = 0.009$ and $p = 0.001$) and low energy procedures ($p < 0.001$). However, the use of high energy reduced the pain at rest for up to one year ($p = 0.001$). Therefore, there is no significant difference between the use of high energy and low energy⁴⁰ **(B)**.

SWT (electromagnetic), when done 3 times (once a month) with 1500 pulses and 0.12 mJ/mm² using echolocation on uncalcified tendinitis with symptomatology for more than 3 months showed no statistically significant reductions in pain or alleviated disability on the Shoulder Pain and Disability Index (SPADI) ($p = 0.097$)⁴¹ **(B)**.

Another possibility is to apply shock wave therapy (electromagnetic) guided by fluoroscopy on patients with calcified tendinitis of the rotator cuff with complaints of pain for more than 3 months and who were unresponsive to conservative treatment with analgesics, non-steroidal anti-inflammatories, subacromial steroid injections, needling of calcification, or physiotherapy. The application of 2500 high-energy pulses (not exceeding 0.45 mJ/mm²) in 2 sessions with an interval of two weeks improved functionality by 24% (CMS) immediately after the procedure (from 50.7 IC95%: 33.2-70.2 to 63.2 IC95%: 23.8-90.0, $p < 0.0001$). Although, in the long term (after 110 days), the use of low and high energy SWT showed improvement in functionality, high energy SWT is superior (t -test, $p = 0.026$; CI = 95% 0.9 to 15.1) in addition to maintaining the symptomatic improvement

of chronic tendinitis for up to 3 months after the application. There were no serious adverse effects, only complaints of headaches and local pain when applying the high-energy SWT⁴² (B).

In patients with calcified tendinitis of the supraspinatus muscle who did not respond to conservative treatment for 6 months, the shock wave therapy (electro-hydraulic, 1500 pulses, and from 0.1 to 0.13 mJ/mm²) using echolocation in 3 sessions with 2-week intervals improved the pain symptoms and the functionality after 24 months, as measured by the UCLA Scale (University of California Los Angeles) (from 12.38 with SD: 6.5 to 28.13 with SD: 9.34, $p < 0.001$) as well as arthroscopy for surgical removal of the calcified deposit (from 9.3 SD: 5.2 to 30.3 SD: 7.62, $p < 0.001$), and as well as the improvement of calcification after 24 months. There is no need for anesthesia or hospitalization to apply SWT, therefore this therapy must be considered before arthroscopy for chronic calcified tendinitis of the shoulder⁴³ (B).

RECOMMENDATION

For the treatment of rotator cuff injuries with shock wave therapy, we observe significant improvements in pain symptoms, functionality, and in immediate and long-term calcification (1 year), with results no better than a placebo, and having a great variety of forms of application (with the majority using a focused apparatus) and quantity of energy (ranging from 0.1 mJ/mm² to 0.45 mJ/mm²) having from 2 to 5 sessions and from 1500 to 6000 pulses and intervals from 1 to 2 weeks between. Still, shock wave therapy must be considered before arthroscopy for chronic calcified tendinitis of the shoulder for improvement similar to improvement of the pain, functionality, and calcification (B).

13. WHAT IS THE BENEFIT OF USING TAPING IN ROTATOR CUFF AFFLICTIONS?

Taping, which consists of wrapping self-adhesive bandages, is often used in the practice of rehabilitation, especially in sports, as much in the treatment as in the prevention of injuries.^{44,45} The main function of taping would be support during movement, however, it is believed that the use of some bandages can improve proprioception and thus diminish injuries and pain.⁴⁴ The most common modality is non-elastic taping, however the use of elastic taping has become increasingly popular by professionals, and some studies are being conducted as to its effectiveness.

In this response we also consider studies made on professional athletes, since the studies on this group are the great majority.

Taping for the shoulder has demonstrated benefits concerning pain relief (B), but show no other benefits.

Thelen et al. demonstrated in a study made among 42 college students diagnosed with tendinitis of the rotator cuff and/or impact syndrome that the use of elastic taping immediately improved pain-free shoulder abduction range by 19.1° in the treatment group when compared to the placebo group ($p = 0.05$ on the first day with no difference after the 6th day) (B). However, the article does not specify whether with re-application the results are the same.⁴⁵

Elastic taping must be applied by a skilled professional using 5 cm, beige, elastic tape for two days, by the following technique:

- The first strip must be applied over the supraspinatus from its insertion to its origin points with the elastomeric bandage in a "Y" strip with tension paper off and patient with cervical inclination contralateral to application and the ipsilateral arm behind the back as if reaching the contralateral back pocket of the pants.

- The second strip, also in a "Y" must be applied on the deltoid representative from its insertion with tension paper off. The first band of the "Y" strip must be applied to the anterior deltoid with the arm rotated outward and adducted 90 degrees. The second band, now for the posterior deltoid, must be applied with the arm still adducted, but now rotated inwardly.

- The third strip, approximately 20 cm in length (could be in "I" or in "Y" depending on size of the contours of the patient's arm) must be applied from the coracoid process region to the posterior proximal deltoid with a manual correction in the tension at the location where the patient would feel pain or increased painful sensitivity (approximately 50% to 75% of the stretching and downward pressure was applied to the tape); the patient maintains the arm in outward rotation and when the tape is being applied distally, the patient must maintain shoulder flexion and slight adduction of the shoulder; at this moment the tape must be applied with no tension.

We must point out that the studies were conducted only for short periods, seeking only changes immediately after application of the different types of taping.

RECOMMENDATION

Despite the data collected showing us that the indication of shoulder taping is still questionable, we recommend its application in rotator cuff injuries to improve the range of pain-free arm abduction⁴⁴⁻⁴⁷ (B). However, we suggest its application as an adjunct treatment, in combination with strengthening exercises of the rotator cuff, needing to be reapplied every three days, considering the response of the patient (D).

Terminology

"Y" strip: this is where the base strip is cut in the middle to make two bands.

"I" strip: this is where the strip is cut in the middle to make two bands; in other words, it is the real base strip.

Tension Paper Off: this means to apply the tape directly to the skin so that it comes loose from the paper on the back part - with approximately 15 to 20% tension.

14. WHAT ARE THE BENEFITS OF STRETCHING AND STRENGTHENING EXERCISES IN THE TREATMENT OF ROTATOR CUFF SYNDROME?

For patients without a completely torn rotator cuff, with pain between 3 and 7 on the Visual Analog Scale - VAS (0-10 cm), or with pain in active abduction or outward rotation and positive quick-test for impact syndrome, the proposal is for strengthening exercises, passive mobilization, massage, and behavioral strategies with various approaches⁴⁸⁻⁵⁰ (A).

A program can be done for strengthening scapula stabilizer muscles for the rotator cuff, soft tissue massage, passive mobilization of the glenohumeral joint, scapular training, postural taping, and mobilization of the vertebral column, in addition to behavioral strategies with set goals, motivation, and positive reinforcement divided into individual supervised physiotherapy sessions of 30 to 45 minutes, twice a week for the first two weeks followed by once a week for the next four weeks, and then every 15 days for the last 4 weeks totaling 10 visits for 10 weeks in the clinic. Subsequent exercises to be done at home on a daily basis for 12 weeks without supervision⁴⁸ (A). It is expected an overall improvement of pain symptoms and increased strength only after the 11th week (RRR = 27%, ARR = 0.241, NNT = 4, CI = 1.32 - 6.39)⁴⁸ (A).

Another treatment option would be 12 sessions of supervised rotator cuff mobilizations, application of ice to the shoulder, supervised strengthening and stretching of the rotator cuff muscles 3 times a week for 4 weeks with deep tissue massage of the supraspinatus muscle, neural mobilization of the radial nerve, mobilization of the scapula, proprioceptive neuromuscular facilitation, and techniques of rhythmic stabilization and relaxation. This way, improvement can be seen of pain symptoms on the visual analog scale from 6.7 ± 0.3 cm to 2.0 ± 0 after treatment, and significant improvement on the range of motion in flexion, abduction, and lateral rotation ($p < 0.05$)⁴⁹ (A).

Even in this group without full injuries, one can choose to do 3 weeks of flexibility exercises on the anterior and posterior of the shoulder for 30 seconds: 3 repetitions with 10-second intervals between each repetition and 6 strengthening exercises using an elastic distracter for the flexor, extender, rotator, and abductor muscles of the shoulder and scapular muscles determined by 10 maximum repetitions, including manual therapy with passive mobilization of the joint seeking an improvement in the shoulder movement arc, the cervical column, and the upper thorax with an intervention of 6 session. It is expected that this treatment will improve pain symptoms by 70%, functionality by 35%, and strength by 16%⁵⁰ (A).

For individuals with complete tearing of the rotator cuff, the conservative treatment proposal may be based on educating the patient (activities modification), non-steroidal anti-inflammatories, physical modalities (ultrasound, infrared radiation, and TENS - Transcutaneous Electro-Neural Stimulation), and an exercise program. The exercise program is divided into three phases: the first is made up of Codman's bent-over exercises, passive flexion mobilization, abduction, extension, lateral and medial rotation, and posterior stretching of the capsule. The second phase consists of strengthening exercises for the rotator cuff muscles, stabilizers of the scapula and deltoid using elastic distracters, and free weights. The last phase involves reintegrating the patients with their normal activities and their work, hobbies, and sports. With this proposal, a significant improvement in pain symptoms is seen from 20.15 ± 8.87 to 40.00 ± 8.58 after 6 months ($p < 0.001$), of functionality as measured by ASES from 24.95 ± 10.17 to 44.15 ± 6.19 ($p < 0.01$) and of muscle strength evaluated isokinetically in the movements of abduction and inward and outward rotation ($p = 0.01$) maintained one year after the intervention⁵¹ (C).

The conservative treatment can be employed in place of surgery in specific cases such as rotator cuff syndrome combined with phase II of shoulder impact syndrome, also with symptoms for more than 3 months with no statistically significant difference. The conservative treatment in these cases consists of using analgesic and anti-inflammatory medications and exercises. It starts by suspending the member by a rope hanging from the ceiling to eliminate gravitational forces. Repeated relaxed movements are made (first, rotation, then flexion and extension, and finally adduction and abduction) for one hour every day, but supervised twice a week. On the other days the exercises are done at home. Resistance is added gradually to strengthen the shortened muscles of the rotator cuff and the scapula-stabilizing muscles. The training can be kept up for 3 to 6 months with gradual lessening of supervision. In addition to this, motivational training must be instituted to guide the training load⁵² (A). The results from the conservative and surgical treatments show no statistically significant difference in the improvement of pain symptoms and range of motion based on the Neer score ($p < 0.01$) after 2 and one-half years⁵² (A).

RECOMMENDATION

The progressive resistance-training program for strengthening the rotator cuff musculature and scapula stabilizers was effective in reducing pain and improving functionality. Manual therapy combined with supervised exercising, with or without motivational intervention, for a period between 3 and 22 weeks, is better than exercise alone for increasing strength, diminishing pain, and improving rotator cuff function. In the treatment of class II injuries of the rotator cuff, no differences were found between surgery and supervised stretching and strengthening exercises (A).

15. IS THE USE OF PROSTHESES RECOMMENDED IN THE TREATMENT OF ROTATOR CUFF SYNDROME?

Functional physiotherapy and self training compared with functional shoulder prosthetics (CooperCareLasttrap model from CooperCare Inc.), used daily for an average of 12 hours for 12 weeks, combined with guidance to avoid work and sports above the shoulder, has the same effectiveness in reducing pain and greater increase in strength than the other treatments when evaluated after 3 months⁵³ (B). There were no exercises associated with using the prosthesis.

RECOMMENDATION

Using a functional prosthetic for the shoulder is an alternative in the treatment of rotator cuff syndrome, bringing a reduction of pain and an increase in strength (B).

16. WHEN SURGERY IS RECOMMENDED, WHAT IS THE BEST POST-SURGICAL TREATMENT?

Physiotherapy after open reconstructive surgery on the rotator cuff, progressing in phases (initially only passive exercises to increase and maintain range of motion, progressing to active exercises, and on to strengthening exercises) shows an increased range of motion (ROM) and muscle strength 6 months after surgery, whether supervised by physiotherapists, unsupervised⁵⁴ (B), or watched on video⁵⁵ (B).

The combination of a continuing, passive, mobilization apparatus (4 sessions of 30 minutes in the first 4 weeks post-surgery) after arthroscopy to reconstruct the rotator cuff shows an improvement of the benefit after 6 months of monitoring when in conjunction with passive ROM exercises (flexion, abduction, outward rotation, and bent-over exercises) supervised by a physiotherapist⁵⁶ (B).

When comparing the recovery of patients with torn rotator cuffs corrected by arthroscopy, aggressive and gradually progressive physiotherapy have shown a similar reduction in pain, strength increase, and ROM improvement after 6 months of monitoring. Aggressive physiotherapy uses movements to increase ROM to what is tolerated (begun immediately post-surgery and maintained for 6 weeks). Gradual progressive physiotherapy uses restricted ROM goals that are progressively increased, using continuous passive mobilization apparatus (twice a day during the first 3 weeks after surgery). It is important to point out that the recurrence of cuff injuries was more significant in the aggressive approach group⁵⁷ (B).

In patients with moderate to severe rotator cuff injuries submitted to open reconstructive surgery, the use of electrical analgesic stimulation (ranging from 1-2 at 60 Hz), with electrodes positioned at specific places (Channel A: angled above the scapula and above the deltoid tuberosity of the humerus; Channel B: beginning and ending at the suture line), starting soon after surgery and used for

one hour, twice a day, leads to a significant improvement in ROM (inward and outward rotation) of the shoulder after 90 days. Passive ROM exercises were included after the 8th week post-surgery⁵⁸ (B).

RECOMMENDATION

Physiotherapy in the post-operative period of rotator cuff surgeries brings an important reduction of pain and an increase of ROM and muscle strength to patients (B), can be done using gradual and progressive exercises, initially with a significant increase in ROM followed by muscle strengthening (B), or in an aggressive way, trying to attain the maximum ROM in the shortest time possible (B). It is important to point out that physiotherapy with an aggressive progression increases the risk of rupturing the corrective surgery (B).

The association of a continuous, passive mobilization apparatus with slow physiotherapy shows benefits when combined with gradually progressive physiotherapy (B).

The use of electrical stimulation of the shoulder can be used in combination with passive exercises for range of motion, as an alternate post-surgical treatment for rotator cuff syndrome (B), however, studies of better methodological quality concerning the conjunction of other therapies are necessary.

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